On page 2, 3rd paragraph to page 4:

The approach to develop a sensory aid based on sensory substitution was guided by knowledge of the structure ~~ands~~ and functional organization of the visual system and by neurophysiological, psychophysical and behavioral studied on visual system recognition in a variety of animals. For example, honeybees use a photographic memory to store and recall patterns in a [[()]pixel by pixel fashion[])]]. However, they also distinguish patterns on the basis of global properties such as radial, circular, and bilateral symmetry. The ~~honeybees~~ honeybee's visual system possesses spatial filters for detecting various symmetries. Radial and circular filters have also been discovered in primate vision. This suggest that information about the presence or absence of different types of symmetry in a visual target may sometimes be useful in the differentiation and characterization of visual forms. In addition many insects that lack stereo vision use image-motion cues (differential movement parallax, changing size etc) to obtain information on depth. Image motion may also provide a powerful cue for segregating objects from their background, detecting imminent collisions, and for computing one's own motion. Likewise, the velocity flow field generated on the retina by different portions of a 3-D object as it approaches may produce sufficient information with which to reconstruct its form. These and other strategies such as visual velocity feedback for gaze and course control and the use of specialized scanning patterns for extracting information on specific features appear to be ~~ubiquituous~~ ubiquitous in vertebrate and invertebrate species where vision plays an important role in directing the animal's behaviour. Consequently any system of sense substitution that aims to compensate for the loss of vision, may well require the subject to implement a set of strategies that are functionally similar to those employed by the visual system in its analysis of the spatial and spatiotemporal features of the ~~subjects~~ subject's visual environment.

On page 10, 2nd paragraph:

Returning to the specific example shown in Figure 1, it can be seen that movement of the cursor 12 over the ~~figure~~ feature 10 will result in the playing of a musical sequence on which the ascending notes G, A, B, C of the second lowest octave and C, D, E, F of the second highest octave are played in succession.

On page 12, 3rd paragraph:

An important aspect of the present invention is the realisation that it is often advantageous to encode a subset of the full image into a musical sequence or sequences. Predetermined features can be extracted ~~form~~ from the image, and said predetermined features may be encoded into a musical sequence or sequences. Feature extraction or pattern recognition algorithms can be used for this purpose.

On page 12, 4th paragraph to page 14:

For complex images it was necessary to extend the battery of search strategies available to our subjects to enable them to carry out a satisfactory exploration and analysis of the target. These included (1) a facility to mask or block out areas ~~areas~~ of the image to enable the subject to carry out a patch by patch exploration and analysis of the target and to selectively examine portions of the image. This was introduced in an attempt to simulate the tactile search pattern that a blind subject normally carries out when ~~tactaully~~ tactually exploring the shape of a solid object. (2) The second major change was to carry out a strategy of feature extraction to segment and produce a set of simplified representations of the image. In our original scheme, the entire image of the "object" was displayed on the computer screen and all pixels constituting the image were thereby primed to activate the release of the appropriate musical notes (that signalled their respective locations on the screen) when they were intercepted by the moving tracker bar. To be fully primed it was necessary and sufficient[[,]] only that a pixel be occupied by part of the image on the screen. To facilitate the analysis of more complex visual shapes we introduced several additional conditions that needed to be fulfilled before a pixel is fully primed to activate the tracker bar. Effectively this is equivalent to having the full image of the "object" appearing on the monitor screen simultaneously by several different spatially distributed sets of feature detectors that each select only those pixels included in those parts of the image that display the selected feature to which a particular array of detectors is tuned. Thus one array of orientation selective detectors may select for priming any set of pixels that lie on well defined vertical lines in the image, while another array of feature detectors may do the same for horizontal lines etc. Further provision is made to allow the subject the choice (i) of selecting which feature (or combination of features) of the image are to be presented and (ii) which "voices" are to be excluded during a particular presentation. By screening the image with several sets of detectors which select for different features (e.g. horizontal, vertical and oblique line components), we can generate musical patterns associated with an image in which all but one of the features have been removed or an image that combines simultaneously[[,]] a number of selected features (such as vertical and horizontal line ~~components, or~~ components) for sounding the whole figure i.e. by priming all the pixels and by arranging to scan and sound all the "voices" (segmented parts of the melody) simultaneously. Effectively this allows the subject to isolate and separately examine the contents of several segmented packages in which different features of the image have been sequestered.

On page 23, 3rd paragraph:

The imaging means can comprise a video camera, although other means, such as CCD or photovoltaic detectors, might be employed. The encoding means performs the functions of analysing the image produced by the imaging means in a suitable manner, and encoding the analysed image into suitable musical sequences. The analysis step might comprise the division of the image, or portions of the image, into the desired number of pixels. It is of course highly desirable that the device is

portable, and thus a small, dedicated microprocessor might be used as encoding means. A small video camera can be used as part of a portable device: the video camera can be incorporated into a hand-held ~~"wand."~~ "wand." In both instances, scanning movements can be accomplished by the person via hand motion or automatically. The playing means can comprise an ear-piece worn by the person.

Charge any additional fees to our Deposit Account No. 23-0280.

Respectfully submitted,

Date: March 4, 2004

By: Monique A. Morneault

Monique A. Morneault, Reg. No. 37,893
Wallenstein Wagner & Rockey, Ltd.
311 South Wacker Drive, 53rd Floor
Chicago, Illinois 60606-6630
(312) 554-3300
Attorneys for Applicant

CERTIFICATE OF MAILING

I hereby certify that this correspondence is, on the date shown below, being deposited with the United States Postal Service with first class postage prepaid in an envelope addressed to Mail Stop Non-Fee Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on March 4, 2004.

Robert Holland

195202